Harvey M. Sapolsky

The Politics of Risk

ALTHOUGH IT DOES NOT CARRY A WARNING LABEL, our political system may be hazardous to our health. It hunts small risks ruthlessly while permitting much bigger ones to exist relatively unmolested. It invests billions, seeking unobtainable safety while failing to provide the resources necessary to protect our future. Hardly anyone is saved by the collective mania with risk; many may be harmed by what goes undone.

Scientists offer little solace in the quest for safety. On the contrary, they often stoke public fears with their ever-increasing ability to detect low levels of potentially dangerous elements in commonly used products and everyday experience. The attempts to calculate the consequences of these exposures do not enlighten because they are based on contested assumptions about the actual exposures and effects of low doses on human health.

Without the constraints of certain knowledge, the regulation of risk becomes intensely political. Most of the participants, locked as they are in separate contests for public support, find advantage in exaggerating potential harms. The result is an unending parade of health threats that confuse more than they guide behavior. Margarine may be better than butter, but it also has its risks. Driving without a seatbelt is dangerous, but eating apples is as well. Smoking kills, but so does nearly everything else.

The question then becomes why there is continuing demand for this confusing bad news about consumer products. American society more than any other is absorbed by the pursuit of minor risks,

Harvey M. Sapolsky is Professor of Public Policy and Organization at the Massachusetts Institute of Technology.

abetted no doubt by the responsiveness of its political institutions. Have we lost our sense of proportion? Is our political system inherently flawed? Are we being irrational or are we being driven to irrational behavior by our political institutions? An old and a new case help us understand the dynamics. But it is the incentives we cultivate that are a problem for society.

ONE OLD CASE

Efforts to promote the addition of fluoride compounds to the public water supply in order to reduce the incidence of dental caries became controversial in the late 1950s and early 1960s, much to the surprise of the proponents, who were mainly public health officials. To them, fluoridation was a major advance, similar to the chlorination of water, the iodizing of salt, and the enrichment of bread, which offered significant public benefits at low costs. Only the ignorant or the misguided could oppose such a gain, it was thought.

The ability of fluorides to prevent tooth decay in children was identified in observations of naturally fluoridated areas, initially undertaken to explain the mottling and discoloration of teeth that also often occurred. Tests were conducted in matched cities to determine the effectiveness on dental health of controlled doses of fluorides. When the results seemed to indicate important reductions in caries for the population under age 16, the Public Health Service with the support of other agencies announced a national program to encourage the adoption of fluoridation by local water authorities.[1]

Opposition to the program quickly developed, primarily but not entirely from the fringe right, which viewed fluoridation as mass medication possibly inspired by Communists. Fluoride compounds, it was noted, were also key ingredients in rodent poisons. Taken over time they could, it was alleged, cause cancer, kidney disease, left-handedness, and many other harms.

Fluoridation did spread rapidly in the United States, but not when the issue was put to a vote. Fluoridation was rejected in over two-thirds of the communities that held referenda to determine the outcome.[2] Adoption was much more likely in jurisdictions, usually larger ones, where the right to petition for a vote was restricted by governing charters and where the matter was settled by nonelected administrators or by powerful mayors persuaded to act by their

health advisors. Thus Chicago, Illinois, had its water fluoridated, but not Fort Smith, Arkansas.

The controversies, often bitterly fought, attracted much attention from the social sciences. The common judgment was that rejection of fluoridation was a sign of public alienation.[3] Unquestioning of health officials who were convinced that fluoridation was safe as well as effective, social scientists viewed rejection as irrational. Their standard explanation for irrational behavior was alienation. The public, they claimed, in one of the few chances it had, was striking out against mass society, big government, and scientific authority.

However, on close scrutiny this argument is unpersuasive. Fort Smith, Arkansas, may have rejected fluoridation, but so did Wellesley and Cambridge, Massachusetts, hardly bastions of the weak, the oppressed, or the alienated. Fluoridation is at risk when there is a referendum, no matter what the demographic characteristics of the community. The only statistical relationship that is significant is a curvilinear one with education: the least and the most educated favor fluoridation.[4]

The referenda campaigns provide a clue to this result. Initially, most citizens surveyed favor fluoridation, generally confusing it with chlorination, the purification of the water supply. As the campaigns unfold, it is clear to those who pay some attention that there is opposition and that there are accusations that fluoridation may pose a health risk. The least educated do not follow the campaigns and may continue to confuse fluoridation with water purification. The most educated can distinguish between established health agencies, which generally favor fluoridation, and opponent organizations, which often use similar sounding names (for example, the National Institutes of Health and the National Health Federation). Those in the middle, the bulk of the population, know enough about the issue to be aware that it is controversial, but lack the time or the sophistication to decipher the sides. Voting against fluoridation becomes a thoroughly rational response to confusing information. Why endorse an experiment with your own health?

The behavior of public health officials provides additional evidence.[5] Among the opponents of fluoridation was an occasional physician or scientist generally lacking in national stature except for a strong antifluoridationist stand. Public health officials typically would refuse to debate them, not wishing to add legitimacy to their claims that fluoridation was a danger. At times, professional sanc-

tions were applied to silence opponents of fluoridation. Most likely, though, citizens conditioned to expect two sides in every referendum found this behavior to be more worrisome than reassuring.

Out of the counterclaims some real risks to health could be discerned. Cosmetically unattractive mottling and discoloration can begin for about 10 percent of the exposed population, even at the controlled levels. In addition, fluoride compounds accumulate in the bones, causing them to be brittle, a hazard especially for the elderly. Kidney failure is also a danger. Perhaps one person in a million might die prematurely because of fluoridation. Those who drink large amounts of water, are dependent upon dialysis care, or consume foods naturally high in fluorides (fish, for instance) are particularly at risk.

More recently, some doubts have been cast about the benefit/cost trade-offs of fluoridation.[6] Improved diets and hygiene may be more the cause of the continuing decline in dental caries recorded in the United States than the diffusion of fluoridation is. Interestingly, the possible rate of one death in a million lifetime exposures that did not deter promotion of fluoridation by public health agencies in the 1950s now sets off regulatory alarms in the very same agencies, whose focus has shifted to protecting consumers from potential harms. The strange protests of the antifluoridationists of the 1950s seem much less strange today.

ONE AMONG MANY CURRENT CASES

Sometimes protective action begins when there is no knowledge of any actual victims. Such is the case with asbestos in the schools and other buildings. The hazards of occupational exposures to asbestos are well established and severe: lung cancer, mesothelioma, and asbestosis. But the health effects of episodic exposures to asbestos building materials are yet to be determined. Nevertheless, school districts across the country have been encouraged to consider removing the materials at great cost. Billions of dollars in expenditures are potentially involved. Ironically, these asbestos products became popular in large part because of their value in reducing fire risks and energy costs.

Concerns about the occupational hazards of mining and fabricating asbestos were expressed as early as the turn of the century, but it was not until the 1960s and 1970s, when the disease burdens of increased exposures resulting from the Second World War shipbuild-

ing effort became visible, that they attracted much attention. Studies showed especially high rates of cancer and lung problems among workers. There were even indications of hazards to workers' families from fibers carried home in clothing used on the job.

In liability suits that followed, it was discovered that the mining firms were at least aware of the hazards, but sought to hide the knowledge rather than warn exposed workers.[7] To limit the punitive awards that quickly mounted on these revelations, Mansville, the leading asbestos producer, sought bankruptcy protection and further eroded public confidence in the industry. Critics, now marshalling wider support, pointed out the potential hazards of the continued use of asbestos in the manufacture of brake linings, fabrics, water pipes, building materials, and other products—the so-called second wave of the asbestos legacy. As a consequence, occupational standards have been greatly tightened over time, and most uses of asbestos have been restricted or banned. Clearly asbestos had become an endangered as well as an endangering product.

The question then arose about what to do with the millions of pounds of asbestos already embedded in society. Water damage and other abuses can cause asbestos materials to deteriorate and to release fibers into the environment. Extrapolations from occupational exposures convinced some that significant risks existed. Attention initially focused on the hazards in school buildings because children were thought to be especially vulnerable to asbestos-related health effects. However, regulators at the Environmental Protection Agency (EPA) envisioned the problem as larger than just that of the schools, likely involving hundreds of thousands of apartment buildings, factories, and office complexes as well as millions of homes. Discussions within the government about a course of action intensified just as the Reagan administration took office with its well-advertised intention to reduce the burden of regulation on business.

Asbestos was drawn into the deregulation debate that ensued because its removal from existing uses would likely be costly and could increase rather than reduce risk if poorly managed. Estimates of the possible harm from casual exposures were continually revised downward, eventually falling to one ten-thousandth that of occupational exposures. The administration's preference was to avoid mandating asbestos removal, but under pressure from the Congress, the EPA did issue a recommendation to the nation's school districts

that buildings be inspected and parents and staff be notified of the existence of asbestos materials. Because asbestos was widely used as a fire retardant and heat insulator, there were soon thousands of frightened parents and school employees clamoring for a cleanup, even though only a relatively few districts actually followed the EPA's recommendation. The administration was unwilling to go any further, delaying promised regulations requiring complete inspections and the initiation of protective measures. Congress intervened to force the EPA to issue the regulations and to monitor the survey of school buildings and the training of inspectors.

Across America, school districts are now looking for friable asbestos and developing plans for its containment or removal. Many are choosing removal, an expensive and risky venture, as it gives the belief, if not the reality, of permanently ridding a site of the hazard. Despite certification programs, asbestos expertise is not very widespread or deep. Many removal efforts have been bungled, leaving school buildings more fiber-laden than they were before. Several billion dollars, most of which will be taken at least initially from local education budgets, will be required to complete the cleanup task. Because neither Congress nor state legislatures have appropriated significant funds for asbestos removal, many districts are suing the materials manufactures for costs and damages. And lurking in the background is an estimated hundred billion dollars in cleanup costs for nonschool buildings.[8]

Surprisingly, little research has been done on the actual hazards posed by asbestos building materials. Current assessments indicate that the most commonly used types of asbestos are not especially dangerous in their manufactured forms.[9] The risk to schoolchildren and other building occupants, but not to asbestos removers and others who poke at it, may be zero.[10] No one yet understands the hazards of the substitute materials. But the fear of asbestos in all its forms persists, as does the urge to poke and remove.

THE LOW-DOSE PROBLEM

We knew fluoride compounds to be poisonous long before their natural presence in water supplies was detectable. It took years for the risks of asbestos mining and fabrication, where the air was thick with dust and fibers, to be fully recognized. Improvements in measuring

techniques now allow the identification of potential hazards in small doses, up to parts per billion. Thus we are aware of minute quantities of Alar in our apple juice and of EDB in our corn muffins. But what we do not know is what will happen to us in twenty or thirty years, the latency period for cancer and other serious disease, if we drink the Alar-spiked juice or eat the EDB-laced muffins.

The toxicity of substances is usually determined in animal studies. The doses in these studies are kept high because animals are normally short-lived and costly to maintain in laboratory settings. However, some results are species-specific and therefore of puzzling regulatory relevance. It was humans, not mice, that suffered from the effects of thalidomide. In contrast, dioxin is highly lethal to mice, but not necessarily so to humans.

To gauge the effects on humans of low to moderate doses generally requires epidemiological studies, but these are often difficult to conduct. For all except the most unusual populations, human experience is quite varied and hard to follow for long periods of time. Closed communities, like those in institutions or isolated occupations, can provide evidence of effects, but only the most severe. In everyday life there are many confounding variables to mask exposure effects. Mortality and morbidity reporting systems, although improving, are not yet sufficient to discover the consequences of low doses in unrestricted populations. Re-creating experience through interviews with disease victims to determine exposure levels is an art dependent upon fallible memories.[11]

Complicating the search for the health effects of chemicals is a number of unresolved technical issues.[12] Attempts to extrapolate from high-dose occupational exposures to low-dose experience are challenged by claims that there may be thresholds which need to be passed before effects occur. The utility of using bioassays for predicting human effects is debated among specialists. It is unclear how to deal with conflict between positive and negative studies, or with effects in one species or sex but not another. Some believe benign tumors are indicative of carcinogenic potential while others do not. There is room for much discretion in risk assessments.[13]

More and more the tendency is for regulators to favor the most risk-averse stance.[14] The Reagan administration's attempt to resist was easily overwhelmed by congressional maneuver and popular reaction. Although studies show a diminishing return to the regula-

tion of product and environmental hazards, the desire to regulate remains unaffected.[15] The public's fear of these hazards is so great that officials dare not admit doubts about the need for the strictest controls. Only the occasional academic asks about the costs of excessive prudence in terms of progress foregone and of more important problems neglected.[16]

THE INCLINATION TO EXAGGERATE

Personal experience is usually sufficient to allow consumers to cope with the traditional hazards of the marketplace. Consumers learn quickly to count their change, to check package weights, and to discount the promises of salespeople. Consumers do not expect much from product warranties and are seldom disappointed. They are deluged by advertisements, but make their own choices. They either comparison shop or pay the price for convenience and full service.

But product health risks are a different sort of market hazard. Few consumers feel comfortable with the measure parts per million, let alone parts per billion. They cannot easily check what has been sprayed upon crops, dumped into the oceans, or fed to livestock. And how many know whether they should use margarine with mono-unsaturated or polyunsaturated fat? Personal experience affords no protection from products that may be slowly clogging arteries or producing cancerous lumps. Instead, consumers must rely upon the risk interpretations of intermediaries—scientists, government officials, reporters, policy advocates, and others—to guide their behavior.

The intermediaries often provide misleading advice. Their views on risks are shaped by professional and organizational interests that encourage, in most instances, the exaggeration of dangers. Their presentation of risk makes small risks become big and big risks bigger, but not proportionally. Consumers are easily confused, thinking health risks are bigger and more alike than they actually are.[17]

No one, of course, knows what are the true risks that consumers face. Lurking on pantry or bathroom shelves may be products that will someday be revealed as silent killers. But it is clear that the public has difficulty in distinguishing between the risks of cigarette smoking and failing to wear seat belts and those of consuming Alar-sprayed apples or living near a nuclear power plant. It is the prism of institutional interests that distorts risk perceptions.

It is not that consumers are intentionally misled. On the contrary, much of the distortion is the unavoidable consequence of professions and organizations competing with one another for scarce resources, in this instance the patronage of a population frightened by the recognition of its mortality. Scientists, individually and by disciplines, compete for recognition and reward; reporters must seek out audiences; public interest advocates need patronage; and government officials have to obtain budgets for their agencies. Even product manufacturers, who might be thought always to wish to underplay risks, can find market advantage in stimulating fears by heralding product versions free of suspect ingredients. Proportionality is easily lost in the clamor for attention and support.

RESPONSIVELY IRRESPONSIBLE

Government policies add to the confusion over risk. There are contradictory statements about particular risks and inconsistent rankings among them. This is not because agencies lack the capacity to establish coherent programs. Each usually has a long-term policy agenda from which it would prefer not to deviate. Most are closely linked to a profession which has predictable norms and predictable goals. That policies are contradictory within and between jurisdictions, and that they may change as does the calendar, is due to our structure of government and the fact that the agencies are subject to political masters who must respond to public pressures in order to retain office.

Convinced that they must appear willing to alleviate every product or environmental fear as it arises, officials make no effort to pursue consistent, carefully designed policies toward health risks. Whatever the scare of the day, officials stand ready to formulate quickly congressional testimony, briefing papers, news releases, and programs that demonstrate their unsurpassed commitment to protecting the public. Dare they hesitate, and an ambitious congressman armed with staff and a subcommittee will leap forward to take their place in front of the cameras. Thus, we are told that the fight to control AIDS is our number-one health priority, but so are the control of cigarette smoking, drunk driving, drug abuse, and teenage pregnancy.

If priorities are always changing, so too are the officials who proclaim them. Every change of leadership brings another shift in policy emphasis, a different personal interest requiring the attention of

subordinates. One secretary of the Health and Human Services Department is a reformed smoker wishing to spread the word; another is a long-time civil rights advocate determined to improve the health services available to minorities. One commissioner of the Food and Drug Administration seeks the mantle of consumer advocate; another wants to be known as a friend to industry. Conservationists recapture the Environmental Protection Agency from the conservatives while a surgeon general makes an in-office conversion to liberalism. Only the publishers of Washington's hundreds of insider newsletters find pleasure in the never-ending parade of personal interest that passes for public policy.

The malleability of the policy-making process is not lost upon interest proponents. Each knows a circuit court that is likely to give a favorable ruling, a local jurisdiction that is inclined to be sympathetic, an academic report that legitimizes a position. State attorneys general, environmental commissioners, and consumer advocates find national reputation and career opportunities in pushing harder. Research institutes committed to support a particular ideology provide tailored studies whose results can be promoted via direct mail, planted stories, or news conferences.

The ability to influence policy outcomes gets increasingly diffused. Once we looked to politicians for policy direction and thought that their manipulative skills were so unusual as to be inborn. Now we know that politicians, or anyone else for that matter, need no special gene to be successful in shaping policy, but only the guileful advice on strategy and image that consultants can provide. The kind of media and campaign expertise that a few firms and trade organizations first developed to protect their interests in referenda is now both intensively studied and widely available.[18] And thanks to foundations and contingency fee arrangements, so too is the high-powered legal representation that once only the largest corporations could afford. For good or bad, almost everyone has a chance to make public policy in America.

The Alar controversy illustrates these points. In 1988 the EPA was laboring through a contended deregistration proceeding that challenged the safety of Alar, a growth-regulating product that keeps apples from falling prematurely off trees. The Uniroyal Chemical Company, Alar's manufacturer, had through the years used many technical consultants on various issues, including some scientists who had a role in advising the EPA on Alar. An advocacy group, the

National Resources Defense Council (NRDC), was a sponsor of a questionable study that found Alar's health risk for children to be several times that of the assessments that the EPA was using. Frustrated by the EPA's cautious, legally constrained response to the study, the NRDC hired a public relations consulting firm to promote its case before the public.[19]

Soon the NRDC's scary findings and the potential conflict of interests of the EPA's science advisors were national news. A "60 Minutes" story kicked off the campaign with cover articles in both *Time* and *Newsweek* following along with dozens of other media features. Meryl Streep, the Academy Award–winning actress, became a celebrity spokesperson for the NRDC, testifying at a hastily called but well-attended congressional hearing about the harm being done to children in the pursuit of Alar profits. Fearing the federal government would not act quickly enough to save a generation from cancer, state governments initiated their own restrictions. Apple sales declined immediately by over 20 percent, costing growers, even those not using Alar, millions of dollars. Before long, Uniroyal capitulated, withdrawing Alar from the market and signaling that it had been outmaneuvered in this round in the contest over food safety policy.[20] No other country has anything near the national tumult over risk issues that America has. Elsewhere governmental authority is more secure, policy-making proceedings more secretive, and official expertise more respected. There is less opportunity, but also less need, for organized interests to use the public's health fears for political advantage. Instead, associations of various types often are given a formal role in determining policy, reducing both the visibility of the process and its potential for inconsistency.

Of course, it is the responsiveness and openness of our political system that we value the most. Inconsistent and even foolish policies may be the consequence of our determination to avoid the centralization of power and to preserve the opportunity for any and all to press a point of view. We leave to the individual the responsibility to choose among them.

CONCLUSIONS

There is no shortage of advice about risks. Let a potential risk be identified and soon all possibly relevant professions, agencies, and

trade groups will offer public positions in order to protect established interests or proclaim new ones. Add the news appeal of risk stories, the availability of advertising dollars to defend and promote products, and the ongoing flood of scientific reports and there is a flood of guidance for the concerned.

Unfortunately, most of the organizations (and individuals) that offer advice on risks are driven to exaggeration. The competition for the attention of peers, donors, editors, public officials, and customers is so intense that the irresistible temptation is to shout in order to be heard. Careers are as much at risk in risk controversies as is the public's health.

Because of the distortions that this competition produces, it is no surprise that consumers have difficulty in sorting out product risk. Some pay little heed to the warnings. Others, following the cautious calculus of the fluoridation referenda, support the strictest regulation of all potential harms and are careful about their own behavior. Still others may pick and choose among hazards, avoiding what they believe are the biggest while ignoring the rest. Likely there is a curvilinear relationship with education, as observed in the fluoridation controversy, and perhaps with income as well. The vast middle in education, income, and age worry the most about their fate.

Product liability laws and administrative action can protect us from some harms. The research investment to ferret out dangerous commodities is large. Despite the opposition of producers, we now have plenty of labels to read. Some products are no longer available for sale; others have their use restricted.

But in the end, there is little to protect against the exploitation of our fears of unknown or marginal harms. We want responsive organizations and professions. Competition keeps these institutions responsive, but at a cost. Americans are traditionally distrustful of government. We need now to be as skeptical of the behavior of research organizations, public interest groups, the news media, and businesses as we are of government behavior because they too find advantage in taking advantage.

Choice is what we desire: the opportunity to select our companions, our politicians, our causes, our entertainment, and our products. In the case of products, no less than in the others, the consequences of our choices can be disastrous. The information that we need in order to choose wisely surely is distorted, but not entirely

absent. Amidst the competitive din there is guidance if we care to, and can, listen carefully. That we persist in ignoring safe pleasures or in reaching for dangerous ones is, however, to be expected, for we cherish the institutions that always permit, and at times even encourage, such errors.

ENDNOTES

[1]Donald R. McNeil, *The Fight for Fluoridation* (New York: Oxford University Press, 1957).

[2]Harvey M. Sapolsky, "Science, Voters, and the Fluoridation Controversy," *Science* 162 (25 October 1968): 427–33; R. L. Crain, E. Katz, and D. B. Rosenthal, *The Politics of Community Conflict: The Fluoridation Decision* (Indianapolis: Bobbs-Merrill, 1969); Diana Chapman Walsh, "Fluoridation: Slow Diffusion of a Proved Preventive Measure," *New England Journal of Medicine* 296 (19) (12 May 1977): 1118–20.

[3]For a summary and analysis of this perspective, see Brian Martin, "The Sociology of the Fluoridation Controversy: A Reexamination," *The Sociological Quarterly* 30 (1) (1969): 59–76.

[4]Harvey M. Sapolsky, "The Fluoridation Controversy: An Alternative Explanation," *Public Opinion Quarterly* 33 (1969): 240–48.

[5]Brian Martin, "Analyzing the Fluoridation Controversy: Resources and Structures," *Social Studies of Science* 18 (1988): 331–63.

[6]Bette Hileman, "Fluoridation of Water," *Chemical and Engineering News* (1 August 1988):26–41; Malcolm W. Browne, "Rat Study Reignites Dispute on Fluoride," *New York Times,* 13 March 1990; Eliot Marshall, "The Fluoride Debate: One More Time," *Science* 247 (19 January 1990): 276–77; "Weak Link on Fluoride and Cancer," *New York Times,* 27 April 1990. See also Tom Christoffel, "Fluorides, Facts, and Fanatics: Public Health Advocacy Shouldn't Stop at the Courthouse Door," *American Journal of Public Health* 75 (8) (1985): 888–91.

[7]Paul Brodeur, *Outrageous Misconduct: The Asbestos Industry on Trial* (New York: Pantheon, 1985); Thomas H. Murray, "Regulating Asbestos: Ethics, Politics, and the Value of Science," in R. Bayer, ed., *The Health and Safety of Workers* (New York: Oxford University Press, 1988), 271–92.

[8]Pamela S. Zurer, "Asbestos: The Fiber that's Panicking America," *Chemical and Engineering News* (4 March 1985): 28–41; Louis S. Richman, "Why Throw Money at Asbestos," *Fortune* (6 June 1988): 155–70; Claudia Copeland, *Asbestos in Buildings: Current Issues,* Congressional Research Service Issue Brief (Washington, D.C., 2 February 1990).

[9]Richard Doll and Julian Peto, *Asbestos: Effects on Health Exposure to Asbestos* (London: Her Majesty's Stationery Office, 1985); B. T. Mossman, J. Bignon, M.

Corn, A. Seaton, J. B. L. Gee, "Asbestos: Scientific Developments and Implications for Public Policy," *Science* 247 (19 January 1990): 294–301.

[10]William K. Stevens, "Risk Is Seen in Needless Removal of Asbestos," *New York Times,* 19 January 1990.

[11]For more on the hazards of epidemiology see Alvan R. Feinstein, "Scientific Standards in Epidemiologic Studies of the Menace of Daily Life," *Science* 242 (2 December 1988): 1257–63.

[12]These issues along with an analysis of their involvement in the development of policy are effectively examined in Mark E. Rushefsky, *Making Cancer Policy* (Albany, N.Y.: State University of New York Press, 1986). See also Kenneth W. Wachter, "Disturbed by Meta-Analysis," *Science* 241 (16 September 1988): 1407–8; John D. Graham, Laura C. Green, and Marc J. Roberts, *In Search of Safety: Chemicals and Cancer Risk* (Cambridge: Harvard University Press, 1988); Malcolm Gladwell, "Risk-Assessment Techniques Throw Researchers a Curve," *The Washington Post National Weekly Edition,* 2–8 April 1990.

[13]Compare Michael Gough, "Environmental Epidemiology: Separating Politics and Science," *Issues in Science and Technology* (Summer 1987): 22.

[14]Sheila Jasanoff, "Cultural Aspects of Risk Assessment in Britain and the United States," in B. B. Johnson and V. T. Cavello, eds., *The Social and Cultural Construction of Risk* (Boston: Reidel, 1987), 388.

[15]John F. Morrall III, "A Review of the Record," *Regulation* (November-December 1986): 25–34. See also Janice Long, "EPA Focuses on Environmental Problems Posing Least Health Risk," *Chemical and Engineering News* (15 January 1990): 16–17.

[16]Albert L. Nichols and Richard J. Zeckhauser, "The Perils of Prudence," *Regulation* (November-December 1986): 13–24; Aaron Wildavsky, *Searching for Safety* (New Brunswick, N.J.: Transaction Books, 1988).

[17]Harvey M. Sapolsky, ed., *Consuming Fears: The Politics of Product Risks* (New York: Basic Books, 1986).

[18]Larry J. Sabato, *The Rise of Political Consultants* (New York: Basic Books, 1981).

[19]"How a PR Firm Executed the Alar Scare," *Wall Street Journal,* 3 October 1989.

[20]Cristine Russell, "As American as Alar Pie," *The Washington Post National Weekly Edition,* 19–25 March 1990. Also Malcolm Gladwell, "A Consuming Matter of Apples," *The Washington Post National Weekly Edition,* 1–7 May 1990; Ann M. Thayer, "Alar Controversy Mirrors Differences in Risk Perception," *Chemical and Engineering News* (28 April 1989): 7–14; Leslie Roberts, "Alar: The Numbers Game," *Science* 243 (17 March 1989): 1430.